

Water Efficiency Case Study: The Society for the Protection of New Hampshire Forests, Concord



A one-hundred-year old non-profit organization, The Society for the Protection of New Hampshire Forests (SPNHF), helps safeguard over a million acres of New Hampshire's wild lands. SPNHF advocates wise conservation of natural resources and promotes proper land stewardship through education, conservation easements, and an extensive land reservation and management system. SPNHF owns and manages 32,685 acres in New Hampshire, most of which is open to the public.

SPNHF's headquarters, the Conservation Center, located in East Concord, demonstrates the organization's dedication to conservation. A new addition to the building consisting primarily of office space opened in 2001 and incorporates much of the best state-of-the-art energy- and water-efficient measures and equipment available today.

The new wing provides a visually satisfying space and maximizes the energy and water efficiency of the building. Designed to take advantage of natural daylight, the bright center atrium needs no artificial lighting even on cloudy days. South-facing windows and skylights in the roof flood the area with light. Expanses of white walls and glass, an abundance of native wood (some harvested from the construction site) and a second story wrap-around planter overflowing with greenery combine in a pleasing mix of beauty and practicality.

When SPNHF planned a new wing for the Conservation Center, they initially planned on installing an onsite subsurface sewage disposal system. However, they discovered that because of the sandy soil at the site, underlain by a clay layer, a conventional septic system could contribute to the pollution of the Merrimack River. The wing is situated only 25 feet from an embankment overlooking the river. Their consultants warned that a conventional septic system installed in sand would not allow for enough attenuation of effluent before seeping through to the clay layer and traveling along it to the embankment and ultimately the river.

Several alternative construction methods were explored and rejected before property manager, Paul Leveille, decided to obtain permission from the New Hampshire Department of Environmental Services (NHDES) for a no-discharge system. After much negotiation, approval was granted. NHDES's Subsurface Bureau did require SPNHF to obtain approval for a conventional septic system design as well, but that system was not installed.

Instead of dumping hundreds of gallons of wastewater a day into a conventional septic system, the bathrooms in the SPNHF Conservation Center's new wing use a miniscule 17 gallons of water a day. The reason for this amazingly low water use is two brands of composting toilet—one that uses no water and another utilizing a mere 2 ounces. In addition, gray water from the kitchen, bathroom sinks, and showers is cycled through filters in a system housed in the basement and pumped to the second floor planters (see Photo 2) where ivy and other plants thrive on the nutrient-rich mix.



Photo 2. Planters showing the copper piping delivering gray water running beneath them. The pipes are invisible from the second floor level. (The crisscrossed pipes are support brackets.)

Composting Toilets:

SPNHF chose two different types of composting toilets for the new wing: a Phoenix brand that uses no water and a Clivus brand that mimics a conventional flush toilet but uses only two ounces of water.

The waterless Phoenix composting toilets, installed in the new wing's main floor bathrooms, use no water and are completely odorless (see Photo 3). Waste goes to a composter filled with planer shavings located in the basement directly below the toilets (see Photo 4). There, it is mechanically mixed with a small amount of water and the shavings. It takes about a year to make compost that will be applied to the outdoor landscape areas at the Conservation Center. The only stipulation NHDES made about the project was that the compost be used somewhere away from public access areas.



Photo 3. Phoenix toilet



Photo 4. Phoenix composter

The Clivus composting toilets on the second floor use a mix of water and aerated soap foam to gently wash down the sides of the toilets (see Photo 5). The Clivus composter works much the same way as the Phoenix model except that the compost must be mixed by hand and no water is added (see Photo 6). Excess effluent from this system is piped to a holding tank and mixed with excess water from the gray water system.



Photo 5. Clivus composting toilet



Photo 6. Clivus composter

None of the composting toilets cause any odors. The secret is an exhaust system that pulls air from the bathroom down through the toilets and into the composters. The oxygen in the air aids the composting process inside the composter. Air from the composter is then vented from the building in the same manner as a conventional toilet. Even the composters themselves, housed behind closed doors in the basement, are odorless.

Gray Water System:



Photo 7. Gray Water System

Kitchen gray water drains to sediment and grease traps located in the basement. Water from the sinks and showers in the new wing enter the gray water system after the traps for kitchen wastewater (see Photo 8). The gray water passes through two filters made from pantyhose and then seeps through a layer of coal slag (a carbon filter) to a pump chamber (see Photo 9). The wastewater passes through a final micron filter before being pumped to the second floor planter boxes. The planters can be bypassed to send excess gray water to a 200-gallon holding tank.



Photo 8. Sediment and grease traps



Photo 9. Filtering tank

A few problems arose with the gray water system. Hot water from the dishwasher is so steamy it melts the grease out of the grease trap and introduces it into the system, creating a slight odor. SPNHF plans to alternately plumb the system so that hot dishwasher water is diverted to a holding tank to cool before being sent through the traps.

Another difficulty resulted from the pumps in the pump tank dosing the planter boxes too heavily, drowning the plants. The pumps are designed to shut off when the water level in the tank drops to a certain level. Placing five-gallon pails full of rocks and bricks in the tank to act as displacement devices solved this problem. The pumps cycle as often as before, but less water is delivered to the planters in each dose.

The final problem, still not completely resolved, centers around the fact that the SPNHF Conservation Center produces more gray water than the planters can currently handle. Presently, the plants utilize only about 45% of the total amount of gray water produced.

One solution scheduled for the summer of 2002 is to divert some of the gray water to an outside planter box. Mr. Leveille plans on constructing the new planter along the south wall and hopes that the nursery stock placed there will utilize water most of the year. Even in cold climates, deeply mulched broad-leaved evergreens like rhododendrons take up water all year round. Though this will not completely solve the excess water problem, it will certainly alleviate the present need to hire a septage hauler to periodically pump out the 200-gallon storage tank.

The gray water system, composting toilets, composters, planter boxes, and all the attendant plumbing cost SPNHF just under \$50,000. Though difficult to estimate, SPNHF's water efficiency measures could save them about \$120 per month on their City of Concord water bills. By using a no-discharge system, they circumvented the expense of installing a conventional septic system. Avoiding the mitigation costs of polluting the Merrimack River is beyond estimation.

Installation of the energy- and water-efficient technology and practices at the Conservation Center has been an easy transition, due mainly to the close association and good communication between SPNHF and their consultants. Another factor that positively influenced implementation was the dedication and enthusiasm of Paul Leveille. If you would like more information about this project, you can reach him at 603-224-9945 or by email at pleveille@spnhf.org. He loves discussing the project!